Use of Assistance Protocols for the Screening of Diabetic Neuropathy in Primary Care: An Integrative Review

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Abstract— The objective was to conduct a survey on scientific evidence regarding the screening for diabetic neuropathy and the use of care protocols in the period from 2015 to 2018. It is an integrative review, with a search for articles in the LILACS, SCIELO, BDENF and databases MEDLINE. Twelve articles were selected, from 2015 to 2018, analyzed using Strauss and Corbin and the IRaMuTeQ software. The largest number of publications occurred in 2017, with 9 (75%) on MEDLINE, all publications (100%) are quantitative in nature, there was a predominance of 9 articles (75%) with Level of Evidence 4. The majority, 11 (91.6%) highlighted the importance of the effectiveness of the association of sociodemographic data and lifestyle, neurological tests and the use of questionnaires. In the Word Cloud, the three most cited words were Peripheral (64), Diabetic (45) and Neuropathic (43). The most cited tests were Monofilament (8) and Tuning Fork (3) and the type of evaluation was the Michigan Neuropathy Screening Instrument MNSI (7). Four categories were identified, namely: "Important risk factors in the screening for Diabetic Neuropathy (DN)"; "ND and associated factors"; "Prevention of diabetic foot" and "Application of MNSI for screening of DN and evaluation of muscle strength for degree of impairment of DN". It is concluded that there is an approach on the forms of neuropathic screening, however the presence of assistance protocols was not identified, which would aim to facilitate this screening. It is hoped that this study can contribute to the formulation of care protocols for the screening of DN.

Keywords—. Diabetic Neuropathy, LILACS, SCIELO, BDENF, databases MEDLINE.

I. INTRODUCTION

Diabetes Mellitus (DM) is a chronic pathology of multiple etiology, due to the absence and / or inability of insulin to perform its functions properly, generating chronic hyperglycemia, often accompanied by dyslipidemia, arterial hypertension and endothelial dysfunction[1].

According to data from the International Diabetes Federation (IDF) in the year 2017, Brazil was in the 4th position among the countries that contained a greater number of people in the age group between 20 and 79 years with DM, about 12.5 million, behind only from China, India and the United States. A projection of 20.3 million is expected for 2045[2].

DM can develop complications when untreated and tracked from the beginning of its evolution due to persistent hyperglycemia [3]. Among these complications, diabetic neuropathy (NP) stands out, considered a more

prevalent microvascular complication, since at least half of individuals with DM will develop this neuropathy in some circumstances of their clinical evolution. Therefore, more attention is needed for measures to avoid this condition[4].

To avoid diabetic complications, it is essential that nurses encourage and assist the person in the development of their care plan and periodically monitor these individuals, guiding them on care with glycemic control, eating habits, physical exercise and, especially, greater attention to the feet, in order to evaluate them, so that they exercise effective self-care, in addition to giving general guidelines on hygiene care, proper footwear and nail cutting, and indication for the treatment of wounds[5].

Early screening and follow-up after the diagnosis of the diabetic patient is essential, since comprehensive and longitudinal care are some of the pillars of primary care. Supporting and encouraging Changes in Lifestyle, in addition to glycemic control, are part of the treatment and

prevent or present complications of DM[6]. In this context, the presence of protocols, known as guides that outline detailed actions and help to arrive at a diagnosis and appropriate interventions, considered fundamental in the assistance, is essential[7].

Given this scenario, the objective of this study was to conduct a survey of scientific evidence on the screening of diabetic neuropathy and the use of assistance protocols in the period from 2015 to 2018.

II. METHODOLOGY

It is a descriptive study, of the type Integrative Literature Review (RIL), considered a method composed of phases, developed according to the purposes of Evidence-Based Practice (EBP) that is configured as a standard of research excellence promoting expressive contributions for science and clinical practice[8]. Described in 6 stages of the RIL[9], namely: Elaboration of the guiding question, sampling in the literature, data collection procedure, critical analysis of the included studies and discussion of the results.

The following guiding question was chosen: What is the scientific evidence on screening tests for diabetic neuropathy and what can be applied in primary care? In the selection of articles, the inclusion criteria were: original articles, in Portuguese, Spanish or English, available in full, that brought a partial and / or full approach to the guiding questions, published in the time frame between 2015 and 2018. The Latin American and Caribbean Health Sciences (LILACS), Scientific Electronic Library Online (SCIELO), Nursing Database (BDENF) e a Medical Literature Analysis and Retrieval System Online (MEDLINE).

The search strategies were guided by the Health Sciences Descriptors[10]. The selected terms were: Diabetic Neuropathies, Protocols and Nursing. They were crossed with each other and, based on the descriptor chosen as the main "Diabetic Neuropathies", productions were sought,

using the Boolean "and" in the search for productions: "Diabetic Neuropathies" AND "Protocols"; "Diabetic Neuropathies" AND "Nursing". Data collection was carried out from November 2019 to January 2020.

Data analysis was performed using the theory based on data by Strauss and Corbin[11], considered to be qualitative, which allows the classification of the conceptual ordering, based on open and axial coding. In the open stage, the IRaMuTeQ *software* was used, the analysis of statistical choice being the Word Cloud and Descending Hierarchical Classification (CHD). IRaMuTeQ allows you to reveal different types of analysis; optimize data organization; in addition to providing maximum methodological rigor in the analysis process, generating more consistent data in the research [12].

In addition, we sought to classify articles according to levels of evidence (LE), in line with the classification of the Agency for Healthcare Research and Quality[13] and in Hughes's perspective[14], the classification of the studies are: LE1 corresponds to the meta-analysis of multiple controlled studies; the LE 2, individual studies with experimental design, that is, randomized. The LE 3 covers research with quasi-experimental design, such as studies without randomization, with pre and post-test groups, longitudinal studies or case control, the LE 4 corresponds to non-experimental studies, namely: correlational, qualitative descriptive or case studies. LE 5; Case reports or program evaluations and, finally, the LE 6 are studies that present the opinions of experts, respected in the area and information not based on research.

III. RESULTS

1.427 articles were found with the descriptors "Diabetic Neuropathies", "Diabetic Neuropathies" AND "Protocols and" Diabetic Neuropathies "AND" Nursing "in the years stipulated from 2015 to 2018, in the LILACS, SCIELO, BDENF AND MEDLINE databases, as viewed in table 1.

Board 1: Identification of descriptors and number of articles in the databases, 2019

Descriptors	LILACS	SCIELO	BDENF	MEDLINE	Total
"Diabetic Neuropathies "	35	14	6	1.344	1399
"Diabetic Neuropathies " AND "Protocols";	0	0	0	5	5
"Diabetic Neuropathies " AND "Nursing".	6	2	4	11	23
Total	41	16	10	1360	1427

Source: Prepared by the authors, 2020.

In total, 63 articles were pre-selected, which answered the research questions. Therefore, articles that did not meet the inclusion criteria were excluded, adding the themes that were distant from the objectives of the present research, namely: publications related to neuropathic pain, animal studies and research on Diabetic Neuropathy that are not applicable in primary care. Thus, after screening the articles, a comprehensive study of the sample that comprised this review was carried out.

At the end of this selection, the final sample consisted of 12 articles, being 1 (8.4%) from 2018, 8 (66.6%) from 2017, 2 (16.6%) from 2016 and 1 (8.4 %) in 2015. Board 2 shows the title, author, year, journal, type of study, objectives, database and level of evidence.

Board. 2: Identification of articles in evidence.

Order of Articles Title	Year Periodical Data base Level of evidence	Kind of study	Objective
1st- Assessment of the risk of ulceration in diabetic individuals.	2018 [15] *Rev Bras Enferm* LILACS; SCIELO; BDENF LE 4	As for nature: Observational, As for development over time: transversal. As for the Approach: Quantitative, classified in analytical	To identify risk factors for foot ulceration by screening for peripheral diabetic neuropathy and peripheral arterial disease in type I and II diabetic patients assisted in reference centers in the Federal District, Brazil.
2nd Prevalence and factors associated with peripheral neuropathy in individuals with diabetes mellitus	2017[16] *J. res .: fundam. care. online* BDENF LE 4	As for nature: observational. As for development over time: transversal. As for the approach: quantitative, classified as analytical	To estimate the prevalence of polyneuropathy (PND) in type 2 diabetic individuals assisted at the Hiperdia Health Care Center, in Viçosa / MG and to identify factors associated with a positive diagnosis of PND through the score of neuropathic symptoms and sensitivity tests.
3rd Assessment of the degree of risk for diabetic foot in individuals with type 2 diabetes mellitus	2017[17] *Rev. Enfer. UFPE on line;* BDENF LE 4	As for nature: observational. As for development over time: Transversal. Approach: Quantitative, classified as descriptive	To evaluate the characteristics of the feet, the degree of risk for diabetic foot and the presence of indicative of neuropathy in individuals with type 2 Diabetes Mellitus.
4th A comparison of screening tools for the early detection of peripheral neuropathy in adults with and without type 2 diabetes	2017[18] *Journal of Diabetes Research* MEDLINE LE 4	As for nature: Observational study As for development over time: transversal. Approach: quantitative	Examine the efficacy of the 128 Hz tuning fork, two monofilaments and Norfolk's quality of life diabetic neuropathy (QOL-DN) as tools for the early detection of diabetic peripheral neuropathy (PND) in overweight, obesity and adult inactivity (OOI) or with pre-diabetes (PD) or type 2 diabetes (T2D).
5th Screening tests for symmetrical distal polyneuropathy in Latin America patients with type 2 diabetes mellitus	2017[19] *Arch EndocrinolMetab.* MEDLINE LE 4	As for nature: observational. As for development over time: transversal. Approach: quantitative	This cross-sectional study aimed to evaluate two bedside tests (Neuropad and VibraTip) as screening tools for distal symmetric polyneuropathy (DSPN) in Latin American patients with diabetes mellitus (T2D).
6th Control of grip strength and hand dexterity are impaired in individuals with diabetic peripheral neuropathy	2017[20] *Neuroscience Letters* MEDLINE LE 3	As for the nature: case-control observational. As for development over time: transversal. Quantitative approach	The objectives of this study were to examine and compare GF control during a simple waiting task as well as GSMax and manual dexterity in individuals with TLD and healthy controls.
7th Prevalence and risk	2017[21]	As for nature: observational. As	We assessed the prevalence and risk

factors for diabetic peripheral neuropathy in young people with type 1 and type 2 Diabetes: RESEARCH for diabetes in the youth study	*Diabetes Care* MEDLINE LE 4	for time: longitudinal and Prospective Cohort type. Approach: quantitative	factors for diabetic peripheral neuropathy (PND) in young people with type 1 diabetes (DM1) and type 2 diabetes (DM2) enrolled in the Youth Diabetes RESEARCH.
8th Cell phone-generated vibrations used to detect diabetic peripherals neuropathy	2017[22] *Foot and Ankle Surgery* MEDLINE LE 3	As for the nature: case-control observational. Quantitative approach	This study seeks to assess whether vibrations generated from a cell phone can be used to track diabetic peripheral neuropathy patients.
9th The association between pulse wave velocity and peripheral neuropathy in patients with type 2 diabetes mellitus	2017[23] *Journal of Diabetes and Its Complications* MEDLINE LE 4	Nature: observational; as for development over time: transversal. Quantitative approach	In this study, we examined the association between OPV and presence, as well as severity of DPN in individuals with DM2.
10th Cross-cultural adaptation to Brazilian Portuguese of the Michigan Neuropathy Screening Instrument: MNSI-Brazil	2016[24] *ArqNeuropsiquiatr* SCIELO MEDLINE LE 6	Nature: observational; Development over time: transversal. Qualitative approach	Cross-culturally adapt the Michigan Neuropathy Screening Instrument (MNSI) to Brazilian Portuguese, verifying its reliability.
11th Efficacy of clinical nerve alternatives Conduction Studies for Screening Distal Diabetes Symmetrical polyneuropathy: a multicenter study	2016 [25] *Diabetes Research and Clinical Practice* MEDLINE LE 4	Nature: observational, development in time: transversal; approach: quantitative	This study explored the possibility of developing an alternative, simple and rapid test for the screening of distal symmetric polyneuropathy (DSPN), for use in local primary care facilities.
12th Prevalence of neuropathy in type 2 diabetic patients and its association with other complications of diabetes: the Verona diabetic foot screening program	2015 [26] *Journal of Diabetes and Its Complications* MEDLINE LE 4	Nature: observational; Quantitative approach	To determine the prevalence and clinical variables associated with somatic neuropathy, using a simple screening method.

Source: Prepared by the authors, 2020.

The largest number of publications occurred in 2017 with 8 (66.6%) and the most found database is MEDLINE with 9 (75%). The analyzed articles are distributed in 11 journals, only one journal presents more than one article in this study, the Journal of Diabetes and Its Complications 2 (16.67%). Regarding the methodological approach, all 12 (100%) are of a quantitative nature.

Regarding the classification (EL1 to EL6) of the quality of published articles, there was a predominance of levels of evidence: EL 6, 1 article (8.3%); El 4 articles, 9 (75%); and El 3, 2 articles (16.67%). Levels 1, 2 5 and 6 were not found in this research. The analysis of scientific publications included the approach of the following

themes: neurological tests applied to screen for DN and description of sociodemographic data, life habits, neurological tests and questionnaires as sources of investigation of DN.

It was found that the majority, 11 (91.6%) publications (articles 1,2,3, 4,5,6,7, 9,10, 11 and 12), highlight the importance of the efficiency of the association of sociodemographic data and lifestyle habits, neurological tests and use of questionnaires. As for the initial data, the importance of collecting the following data was identified in the articles: gender, age, race, marital status, education, type of DM, year of DM diagnosis, presence of Systemic Arterial Hypertension, use of insulin, glycohemoglobin,

dyslipidemia, previous ulcer, obesity, smoking or alcoholism, anamnesis of the feet to identify the dry skin, calluses, edema, interdigital mycoses, cracks and loss of protective sensitivity. Among the neurological exams mentioned in the articles, the following stand out: thermal sensitivity; monofilaments, 128 hz tuning fork, Vibratip and Achilles reflex.

With regard to the assessment instruments, there are: the Neuropathic Symptom Score, Neuropathic Commitment Score, the Michigan Neuropathy Screening Instrument (MNSI) score and the Norfolk Quality of Life-Diabetic Neuropathy (QOL-DN) questionnaire, which associates decreased quality of life due to risk of neuropathy. Only 1 (8.64%) article (number 8) highlights only the use of neurological tests to identify neuropathy, namely: 10g Semmes-Weinstein monofilament, 128Hz tuning fork and a vibrating cell.

For the analysis of the data collected in the RIL, the IRaMuTeQ *software* was used, which made it possible to establish a relationship between the linguistic context found in each research contained in the RIL sample and the representation of diabetic neuropathy in the context of health care its early identification and the importance of paying attention to this complication of Diabetes Mellitus.

The Word Cloud was used, as shown in figure 1, which allowed the identification of the most cited words in the studies, based on the combination of words according to their frequency. Thus, the most frequent words found were: Peripheral (64), Diabetic (45), Neuropathic (43), Motor (34), Sensory (34), Polyneuropathy (34). In relation to the most cited tests are: Monofilament (8) and Tuning fork (3) and in relation to the most frequent evaluations carried out is the Michigan Neuropathy Screening Instrument MNSI[7].
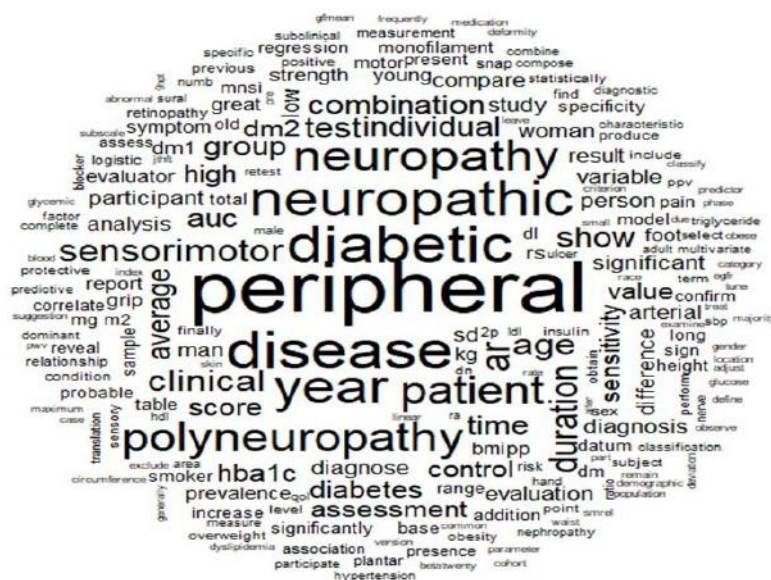

Fig.1: Word cloud - Analysis of the Results of the Integrative Review.

Source: IRaMuTeQ, 2020.

The analysis of the linguistic context was also carried out using the descending hierarchical classification (DHC) method. Words were selected for their significant frequency and higher Chi-square values. The analyzed corpus of the research was composed of 12 initial context units (UCI) corresponding to the 12 results of each research analyzed in the RIL sample, which the program divided into 168 segments of elementary context units

(UCE), which contained 1256 words or distinct forms that occurred 5673 times, followed by the number of slogans: 1036. Regarding the frequency in percentage of each class: class 4 (22.6%); class 3 (27.4%); class 2 (28.6%) and class 1 (21.4%).

The filogram, format from the Descending Hierarchical Classification (DHC) dendrogram, as shown in figure 2.
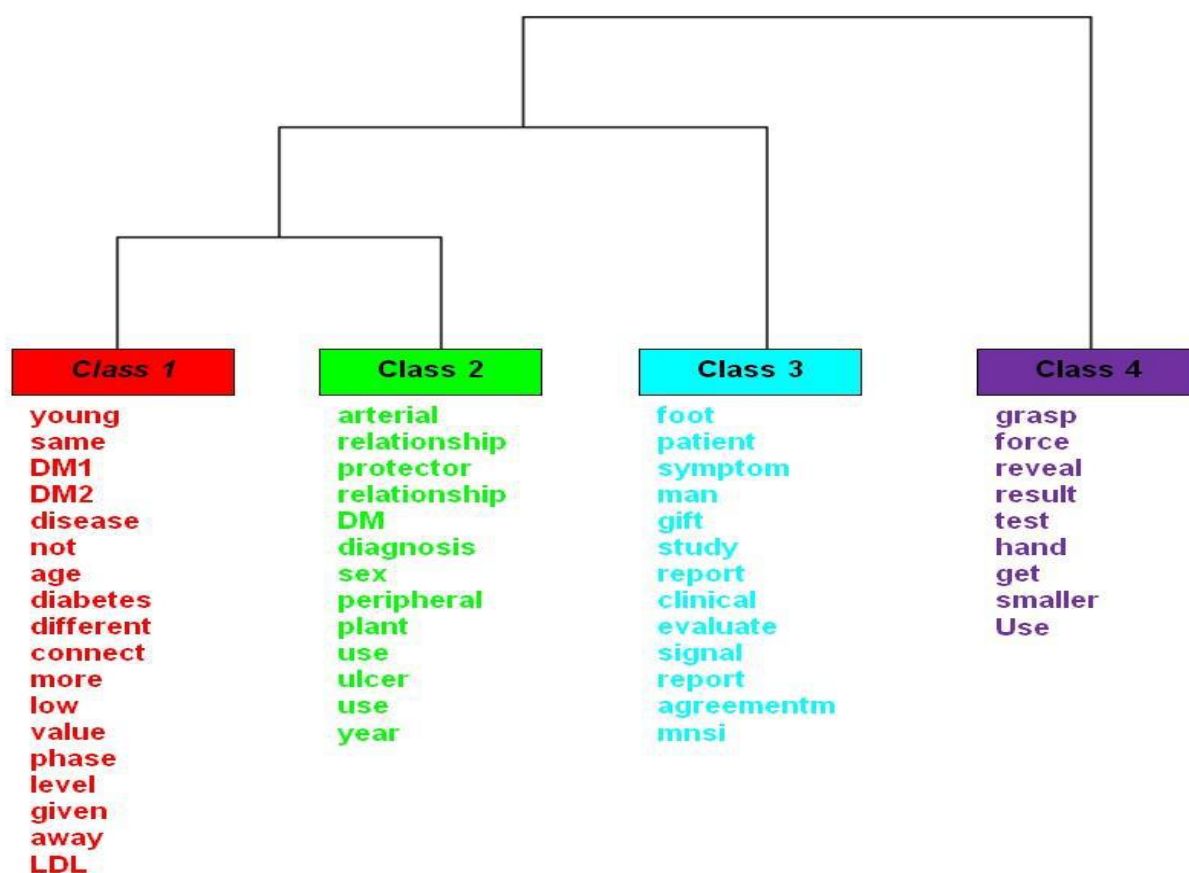
Fig.2: Descending Hierarchical Classification

Source: IRaMuTeQ, 2020.

The four classes proved to be stable, that is, composed of Elementary Context Units (ECU) with similar vocabulary. In class 4, the most representative words were: hand, test, grip, strength, reveal, result; and, to a lesser extent: obtain, use and minor. As for class 3, the most evident words were: man, symptom, foot and patient, followed by: MNSI, score, evaluate, report, clinical, sign, present, study. In this lexical focus group, two important points must be considered: the prevalence of patients in relation to the male sex and evaluation using the MSNI score.

Class 2 of the dendrogram revealed the following most expressed words: protector, diabetic, diabetes mellitus (DM), relationship, arterial, peripheral, pain, plant; followed by the least evident: ulcer and year.

Regarding class 1, the most frequent semantic range of words in the text was: young, DM 1; DM 2; Hba1c; disease and those that were less prominent: age, value, phase, level, plus, low, Area under the curve (ASC), LDL, different, data and associated. This result refers to the characteristics of the population in the studies and data that emit risk factors for diabetic neuropathy. Much of the

research uses information on time and type of DM, associated diseases and glycated hemoglobin (HbA1c) values.

IV. DISCUSSION

In view of the results found in the Word Cloud, the most repeated word was "peripheral", the most cited test was the monofilament test and the most frequent instrument for evaluation was the Michigan Neuropathy Screening Instrument (MNSI). In this context, NP affects the components of the peripheral and autonomic nervous system, in which the pathophysiological process is configured, which can lead to ulceration and amputation of the lower limbs [27].

The monofilament test is considered essential for screening for DN. The Nylon Monofilament test is the gold standard for screening diabetic neuropathy, in addition to being a viable resource to be used in primary care because it is low cost[28]. The isolated 10 g monofilament, although capable of indicating a decrease or absence of protective sensitivity, does not conclude the diagnosis of diabetic

neuropathy, which reveals the need for further tests for its screening[29].

Among the multiple clinical instruments that can be used for screening for DN, includes the Michigan Neuropathy Screening Instrument (MNSI), as listed in this research. The MNSI consists of a questionnaire and physical examination, ranging from zero to thirteen. A score of eight or more characterizes the individual as a neuropath[30], [31]. In a survey carried out to assess the presence of DN, through the MNSI and by the esthesiometry test, the presence of DN was identified in the majority of those evaluated. The use of the two instruments has a significant correlation[31].

It is important to note that there are other screening tests, namely: the Neuropathy Disability Score (NDS), or also known as the Neuropathic Impairment Score, and Neuropathy Symptom Score (NSS), Neuropathic Symptoms Score. They serve to assess signs of neuropathy and the number of neurological symptoms presented by the patient, respectively. The first includes assessment of the Aquileu reflex and vibratory, painful and thermal sensitivities in both lower limbs, the second analyzes symptoms related to changes in sensitivity[32].

As for the categorizations, from the analysis of the category 4 filogram, it is strongly marked by forms associated with the aspects and factors that lead to reflect on the consequences of diabetic peripheral neuropathy (PND) affecting the sensory function of the hands and dexterity[33].This study corroborates with research that states that, although the most serious consequences of NP are evident in the lower limbs, the hands are also affected by the loss of sensory information, since neuropathy is characterized by sensory and even motor deficits, therefore, it is possible for diabetics to show problems in performing manipulative tasks[34].

As for category 3, two important points must be considered: the prevalence of patients in relation to the male gender and evaluation using the MSNI score, which are fundamental elements in the analysis for the prevention of diabetic foot. It is known that there are countless risk factors associated with the progression of diabetic polyneuropathy, among which the following stand out: advanced age, male gender, longer duration of diabetes, insulin therapy, clinical conditions, among others. Thus, it is relevant to observe in studies, the prevalence of DN between genders due to risk factor [35].

Diabetes in patients with DN is more prevalent in elderly individuals over the age of 60 years, especially among men[36]. Regarding the MNSI-Michigan Neuropathy Screening Instrument, a type of instrument with a DN screening questionnaire, composed of scores, it is important for the assessment of neuropathy[37]. Several articles in the present study addressed this statement[18], [21], [24], [26].

Category 2 of the dendrogram, categorized as "Diabetic neuropathy and associated factors", stands out that the word arterial, which is related to some studies that addressed the screening for DN and peripheral arterial disease (PAD) in diabetic individuals type I and II , as the presence of PAD can be found in diabetic patients. The association of ND and PAD tests are considered to be evaluations recommended both nationally and internationally, as they are factors directly related to foot ulcers[38]. It is noteworthy that the word ulcer, even if less prominent, matters because it directly refers to the consequence of diabetic neuropathy that should be avoided from primary care, since neuropathy is the main risk factor for foot ulceration in individuals with diabetes[39].

With regard to category 1, entitled: "important risk factors in the screening of DN", it refers to the characteristics of the population of the studies and data that emit risk factors for Diabetic Neuropathy. Much of the research uses information regarding the time and type of DM, associated diseases, and glycated hemoglobin (HbA1c) values. In this context, the studies that most highlighted and described these factors mentioned in the corpus[16], [18], [19], [21], [23], [26], [38], [39] stand out. It is worth noting that the association of the word youth seen in category 1 is related to DM1, because it is one of the most evident chronic pathologies in childhood and has its greatest incidence in the period of adolescence [40].

Regarding other risk factors for DN, it is important to highlight that glycated hemoglobin (HbA1c) is the most suitable test to quantify the risk of chronic complications such as DN in diabetic patients[41].

The duration of diabetes mellitus and the patient's advanced age are relevant factors associated with the monofilament test to detect the presence of neuropathy among diabetic patients and those, with loss of plantar sensitivity by the monofilament test, also showed worse metabolic control, corroborating the need to identify risk factors for the complete screening of diabetic neuropathy[42].

V. CONCLUSION

The objective of the research was the identification of care protocols used in the identification of Diabetic Neuropathy, however, it was found that there is a general approach to neuropathic screening tests, however there are no descriptions regarding care protocols, which would aim to facilitate the screening for disease prevention, in addition to allowing greater flexibility for health

professionals. The improvement in the organization of work based on the application of care protocols can allow the empowerment of the user regarding the importance of self-care in controlling DM and improving quality of life, in addition to adherence to treatment to avoid complications.

It was identified that the survey of sociodemographic data and lifestyle habits are important and that the use of tests for screening should be applied. In view of the results, the most elucidated test was the monofilament and the most frequent instrument for evaluation was the Michigan Neuropathy Screening Instrument (MNSI). Among the highlighted complications are not only changes in the feet, but also in the hands, the pathology mainly affects the male gender, people of older age and longer duration of DM. The presence of associated pathologies, such as PAD, in diabetic patients must be evaluated, as well as the records of blood tests.

It is hoped that this study can contribute to the formulation of assistance protocol for the screening of the complication of DM, diabetic neuropathy, preventing the user from reaching other points in the health care network, thus preventing the worsening of the clinical condition, as in the case of diabetic foot, in addition to the costs of hospitalization.

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